

WHAT IS CLAIMED IS:

1. A method of forming an opening in a dielectric layer, comprising:
  - providing a substrate;
  - forming a doped dielectric layer on the substrate;
  - forming a undoped dielectric layer on the doped dielectric layer;
  - forming a mask on the undoped dielectric layer, wherein the mask has a first opening therein for exposing a portion of the undoped dielectric layer;
  - performing a ion implantation step with the mask on the undoped dielectric layer, so that a doped region is formed in a portion of the exposed undoped dielectric layer below the first opening, wherein a depth of the doped region does not exceed a thickness of the undoped dielectric layer;
  - performing a chemical vapor etching step with the mask on the undoped dielectric layer to remove the doped region, thereby forming a second opening that exposes a portion of the undoped dielectric layer below the doped region; and
  - performing a dry etching step with the mask on the undoped dielectric layer, so that the portion of the undoped dielectric layer below the doped region and a portion of the doped dielectric layer below second opening are removed to expose a portion of the substrate.
2. The method of claim 1, wherein the doped dielectric layer includes a tetra-ethyl-ortho-silicate (TEOS) layer doped with boron (B) ions.
3. The method of claim 1, wherein the doped dielectric layer includes a TEOS layer doped with phosphorus (P) ions.
4. The method of claim 1, wherein the doped dielectric layer includes a TEOS layer doped with boron (B) and phosphorus (P) ions.

5. The method of claim 1, wherein the doped dielectric layer includes a doped silicon nitride layer
6. The method of claim 1, wherein the undoped dielectric layer includes an oxide layer.
- 5 7. The method of claim 1, wherein the undoped dielectric layer includes a silicon nitride layer.
8. The method of claim 1, wherein the step of performing the ion implantation step includes implanting boron (B) ions in a portion of the exposed undoped dielectric layer below the first opening.
- 10 9. The method of claim 1, wherein the step of performing the ion implantation step includes implanting phosphorus (P) ions in a portion of the exposed undoped dielectric layer below the first opening.
10. The method of claim 1, wherein the step of performing the ion implantation step includes implanting arsenic (As) ions in a portion of the exposed undoped dielectric layer below the first opening.
- 15 11. The method of claim 1, wherein the chemical etching step includes hydrofluoric vapor etching step.
12. The method claim 1, wherein the depth of the ion implantation region is at least 70% of the thickness of the doped dielectric layer.
- 20 13. The method of claim 1, wherein the depth of the second opening region is at least 70% of the thickness of the undoped dielectric layer.
14. The method of claim 1, wherein the mask includes a photoresist.
15. The method of claim 1, further includes a stripping step for removing the mask after the dry etching step.

16. A method of forming an opening in a dielectric layer, comprising:

providing a substrate;

forming a undoped dielectric layer on the substrate;

5 forming a photoresist on the undoped dielectric layer, wherein the photoresist includes a first opening for exposing a portion of the undoped dielectric layer;

performing an ion implantation step with the photoresist serving as a mask for forming a doped region in the undoped dielectric layer located under the first opening, wherein a depth of the doped region does not exceed a thickness of the undoped dielectric layer;

10 performing a chemical vapor etching step with the photoresist serving as the mask for removing the ion implantation region so that a second opening is formed to expose a portion of the undoped dielectric layer; and

15 performing a dry etching step with the photoresist serving as the mask for removing the exposed undoped dielectric in the second opening, thereby exposing a portion of the substrate.

17. The method of claim 16, wherein the chemical etching step includes hydrophosphoric vapor etching step.

18. The method of claim 16, wherein the depth of the doped region is at least 50% of the thickness of the undoped dielectric layer.

20 19. The method of claim 16, wherein the depth of the second opening region is at least 50% of the thickness of the undoped dielectric layer.

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